So, who needs PureFlow™ Diesel Systems? Anyone who wants to:

- **Reduce fuel cost up to 6% or more, depending on application;**
- **Increase horsepower and productivity up to 20% or more;**
- **Significantly reduce exhaust emissions; and**
- **Extend engine life by restoring injection timing and providing smoother engine run.**

The Problem

Diesel manufacturers provide the most advanced, powerful engines in the world, and under test cell conditions these engines are a marvel of engineering. However, in real world applications, diesel engines generally fall short of test cell performance in terms of power, fuel efficiency and exhaust emissions. This is due in large part to shortcomings in the "fuel delivery system." The typical engine transfer pump operates as part of a "vacuum feed system" instead of a "pressure feed system" (like in the test cell). This transfer pump creates a vacuum that pulls fuel from the tank, through the fuel filter, and then to the transfer pump.

Due to the volatile nature of petroleum distillates in diesel fuel and restrictions caused by fuel line routing and fuel filters, the fuel can "cavitate" producing vapor. Cavitation increases at higher fuel flows and as filters clog. If the engine is operating much above sea level, the situation gets worse due to reduced atmospheric pressure.

Furthermore, air can become "entrained" in the diesel fuel due to sloshing in the tank and via ultrasonic vibration in both mobile and static fuel tanks. In fact, OEMs report through their service literature that up to 10% air can become entrained in diesel fuel in field service. The result is that air and vapor reach the engine transfer pump due to shortcomings in the fuel delivery system.

Never heard of "entrained air?
These people have:

Caterpillar® Special Bulletin 651-1250:
"Normally, #2 Diesel Fuel contains about 10% air in solution, although the air is not visible."

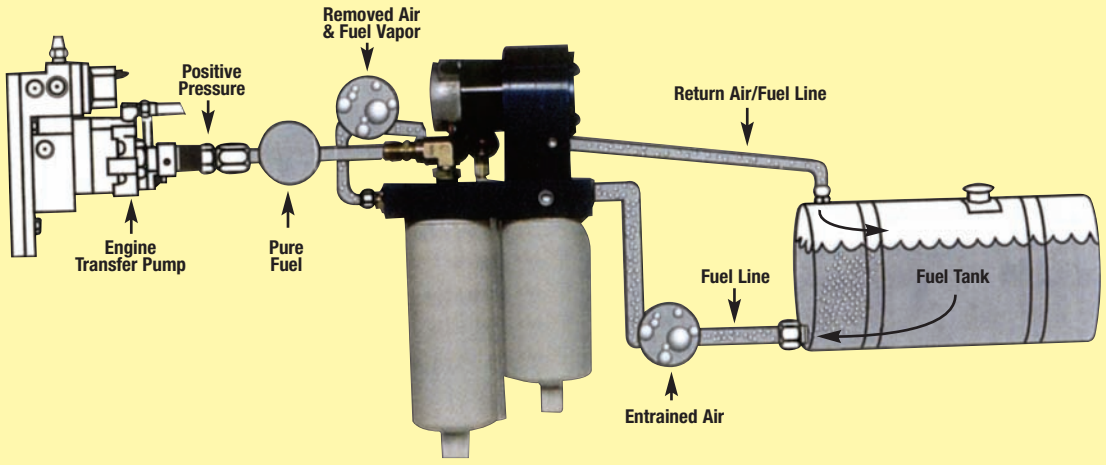
Cummins® Service Topic 5-135:
"The source of the vapor is the fuel itself."

The Fluid Power Institute at the Milwaukee School of Engineering
confirms that entrained air and vapor are present in all liquids, especially petroleum-based liquids.

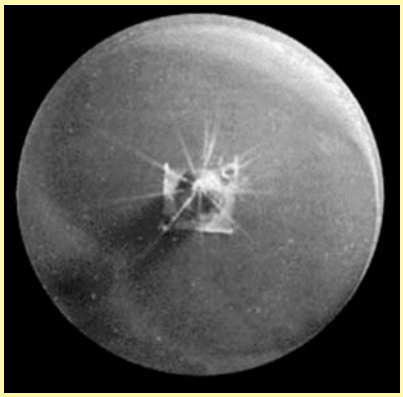
These conditions degrade engine performance. Cavitation starves the engine transfer pump. Inadequate flow causes the engine transfer pump to cavitate reducing the flow to the fuel rail and ultimately to the injectors. This reduces engine efficiency. Of more concern, both air and vapor are compressible. The engine fuel system carries these gases along with the liquid diesel fuel through the fuel rail and into the injector. To build sufficient injector pressure, the injector plunger must first compress these gases, using up valuable plunger stroke and crank rotation angle. The plunger must travel further, so the timing is delayed ("retarded") and performance suffers. This retarded injection timing varies randomly with each injection stroke and is the source of the rough idling that is an accepted "fact of life" in almost all diesel engines.

The Solution

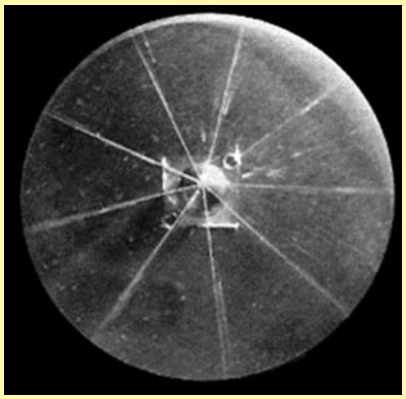
Field and independent laboratory testing both prove that **RETROFITTING ENGINES WITH THE PUREFLOW™ DIESEL SYSTEM SOLVES THE SHORTCOMINGS OF THE STANDARD FUEL DELIVERY SYSTEM AND IMPROVES ENGINE PERFORMANCE!** The PureFlow™ patented vapor removal/fuel pump retrofit system (1) removes entrained air and vapor; (2) pumps pure diesel fuel to provide positive head pressure to the engine transfer pump; and (3) eliminates fuel cavitation from the engine transfer pump.



This restores fuel delivery to “test cell” conditions, eliminates the adverse consequences of transfer engine pump cavitation and improves engine performance. Injector spray patterns show the improved performance with PureFlow™.



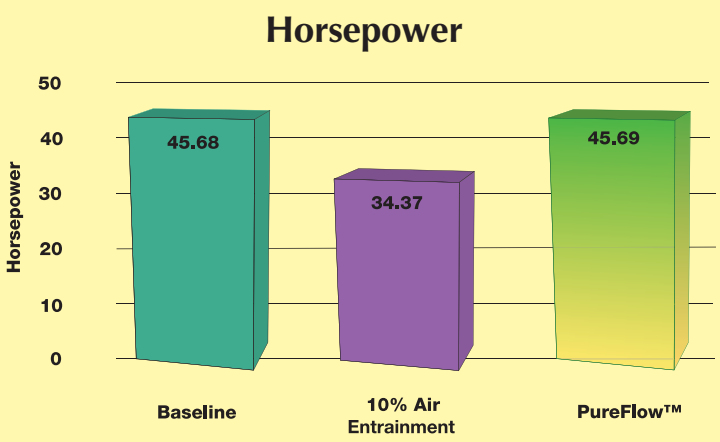
Injector spray pattern without PureFlow™

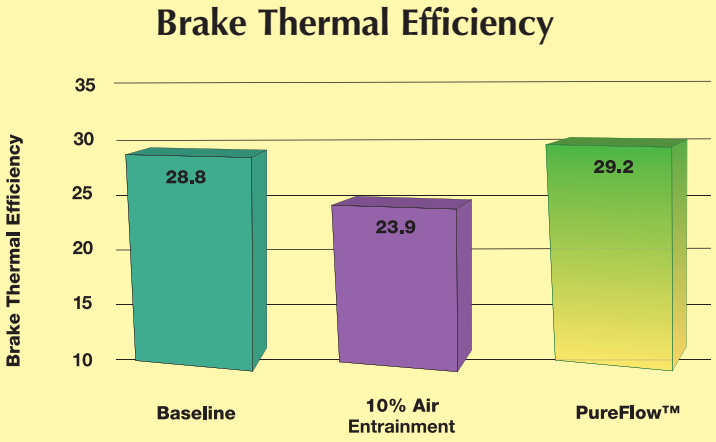


Injector spray pattern with PureFlow™

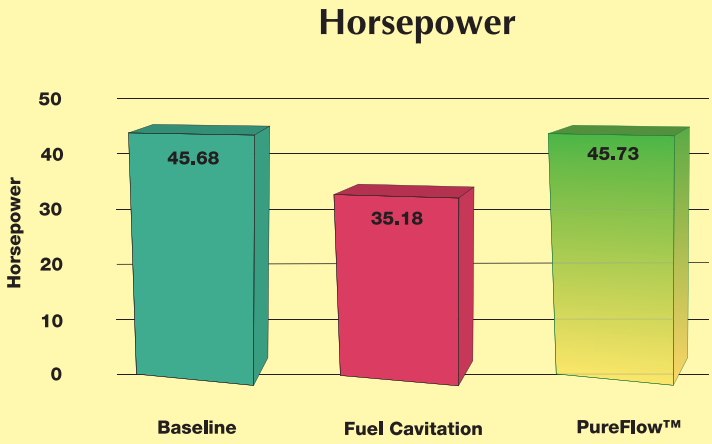
Laboratory Test Results

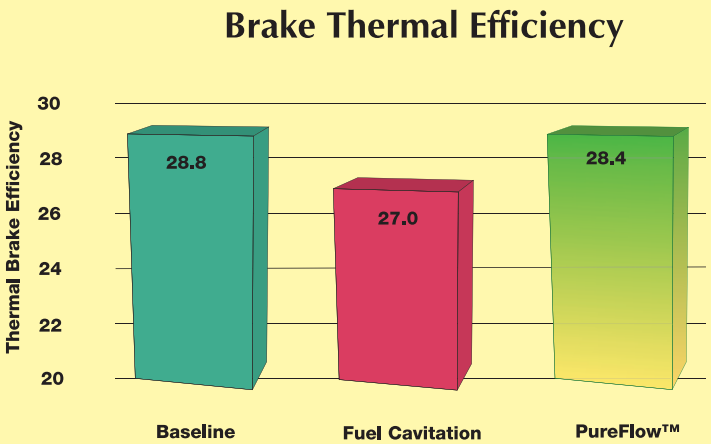
Independent laboratory tests*, showed that in 8-mode off-road applications with 10% entrained air horsepower dropped from 45.6 hp to 34.37 hp and brake thermal efficiency dropped from 28.8% to 23.9% (a 17% reduction in fuel efficiency**). PureFlow™ Diesel System restored both horsepower and fuel efficiency.





With cavitation, horsepower dropped from 46.68 hp to 35.18 hp and brake thermal efficiency dropped from 28.8% to 27% (a 6% reduction in fuel efficiency). After installing the PureFlow™ Diesel System, both power and fuel efficiency were restored.



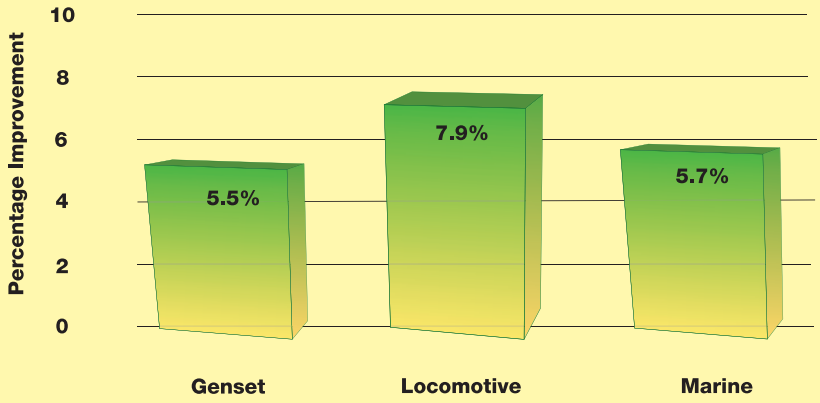


**Tests were conducted by Olson Ecologic Engine Testing Labs, LLC, Fullerton, CA, an ISO 9001:2000 registered lab. The ISO 8178 test protocol was followed on a Caterpillar 3045 direct injection engine rated 90 hp at 2400 rpm. Using the 8-Mode off-road vehicle test cycle, tests compared baseline engine performance to engine performance with (1) 10% entrained air, (2) induced cavitation, and finally, (3) both of those conditions but with the PureFlow™ Diesel System installed in place of the fuel filter.*

***Fuel efficiency is technically measured as "brake thermal efficiency" which is a generic description of work output per energy input. A diesel engine provides approximately 33% brake thermal efficiency, as each gallon of fuel produces 1/3 fallon of useful work, while 1/3 of the provided energy is wasted out the radiator and 1/3 is wasted out the exhaust pipe. Therefore, 33% brake thermal efficiency equals maximum fuel efficiency.*

Test data analyzed for generator set, locomotive and marine applications demonstrated that across all applications, PureFlow™ Diesel System **improved fuel efficiency above baseline engine performance** and restored the horsepower and fuel efficiency losses caused by entrained air and/or cavitation.

PureFlow™ Fuel Efficency Improvements Above Baseline Engine Performance



Field Test Results

Field testing conducted on large engines corroborates the laboratory test results.

Side-by-side field testing was performed on two Caterpillar 398 engines used in a drilling application. With both engines operating under identical loads, the fuel consumption improved over 6% with the PureFlow™ Diesel System.

Brake specific dynamometer tests performed on an Electro-Motive Division 16-645 E3C showed efficiency improvements across the entire range of operating speeds. The rebuilt locomotive engine modified for marine service showed fuel savings exceeding 5%.

Tests performed on a Caterpillar 170 ekw 60 Hz Model 3306B with Caterpillar SR 4 Generator showed at 160 ekw fuel consumption improved from 11.4 to 10.08 gph (13.1%) and at 60 ekw fuel consumption improved from 5.5 to 5.32 gph (3.6%).

In a Class 8 trucking application, a 1998 Cummins N14-525 on Freightliner Century demonstrated increased average drive speed (48.56 mph to 52.23 mph), increased percentage distances at maximum speed (16.44% to 21.83%) and increased fuel efficiency (6.52 mpg to 7.34 mpg). Test results based on ECM download.

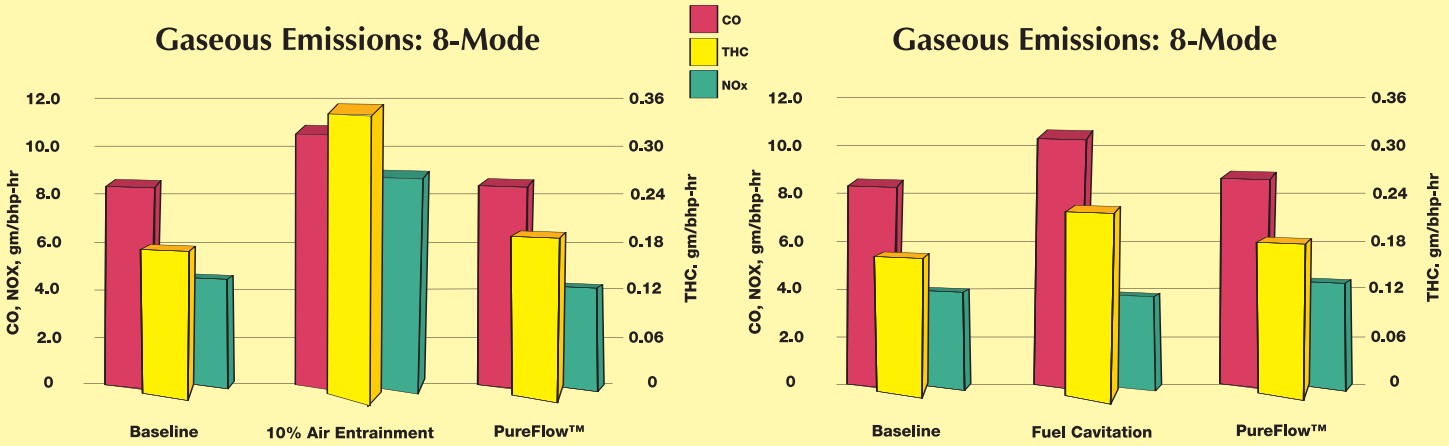
The Savings

What does 6% or more improved fuel efficiency mean to you? -- ***IT MEANS BIG SAVINGS!*** This chart calculates the savings based on annual consumption with fuel cost at $2.50 per gallon. See the savings based on your annual fuel consumption.

Fuel Savings Based on Annual Consumption ($2.50 / Gallon)					
Total Annual Fuel Consumed	**20,000 Gallons**	**100,000 Gallons**	**500,000 Gallons**	**1,000,000 Gallons**	**1,500,000 Gallons**
Total Fuel Cost	**$50,000**	**$250,000**	**$1,250,000**	**$2,500,000**	**$3,750,000**
Annual Fuel Savings					
3.0%	**$1,500**	**$ 7,500**	**$37,500**	**$ 75,000**	**$112,500**
4.0%	**$2,000**	**$10,000**	**$50,000**	**$100,000**	**$150,000**
5.0%	**$2,500**	**$12,500**	**$62,500**	**$125,000**	**$187,500**
6.0%	**$3,000**	**$15,000**	**$75,000**	**$150,000**	**$225,000**
7.0%	**$3,500**	**$17,500**	**$87,500**	**$175,000**	**$262,500**
8.0%	**$4,000**	**$20,000**	**$100,000**	**$200,000**	**$300,000**
9.0%	**$4,500**	**$22,500**	**$112,500**	**$225,000**	**$337,500**

Restores Emissions Performance

Exhaust emissions are an increasing environmental concern. With fuel efficiency improvements of up to 6% or more, total fuel consumed is reduced, so total exhaust emissions are reduced as well! Field test results on DEUTZ BF4M 1013C showed that after only 100 hours of "run in" the NOx emissions decreased 44% (1043.98 to 582 ppm). Lab test results also indicate that PureFlow™ Diesel Systems restore exhaust emissions that normally increase due to air entrainment and cavitation.



So, who needs PureFlow™ Diesel Systems? You do!

To learn more about how PureFlow™ Diesel Systems can benefit you contact us at

PureFlow™ TECHNOLOGIES, INC.

5400 Business 50 W., Suite 8
Jefferson City, MO 65109
Phone: (573) 635-0555
Toll Free: (877) 463-4373

www.pureflowtechnologies.com